Minos·X
User Manual

Version 1.2 26 February 2013

Revision	Date of Revision	Changes	Name
Version 1.2	26 February 2013	Added Turbidity•Xchange information, Supported Sensor Configurations	Dustin Olender

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General Description of the Instrument

AML Oceanographic X-Series instruments and sensors provide a major improvement in ocean instrumentation by allowing the user to swap and interchange sensors. With this system the user gains many advantages over traditional systems, including:

- Changing the instrument sensor types, while at sea, within seconds, and without tools. For example the same instrument can be changed from a CTD to a sound speed profiler.
- The sensor ranges can be swapped as sampling conditions change to maximize the instrument's resolution and accuracy. For example, a deep pressure sensor can be swapped for a shallow pressure sensor, and the salt water conductivity sensor can be swapped for a fresh water conductivity sensor.
- Sensors from one instrument can be swapped to another instrument to maintain mission critical capabilities.
- Calibrated sensors can be sent to the instrument so that the instrument does not need to be removed from service for calibration.
- Spare sensors ensure that an instrument can be immediately returned to service after catastrophic damage, such as a high speed impact with the ship's hull.
- All calibration and traceability data resides within each sensor. There is no need update instrument configuration files or coefficients. Calibration data for all sensors is instantly available from the instrument, and calibration certificates can be printed from AML Oceanographic's SeaCast software whenever the instrument is connected.
- Logged data is stamped with sensor traceability and instrument configuration data. So there is never a doubt about how the data was collected or the status of the sensor's calibration.
- Since only the sensors need to be returned for recalibration the shipping costs are dramatically reduced.

The Minos•X is the compact, multi-sensor, data logging instrument of the X series family. It is designed primarily for small boat and hand deployed operations. It provides all the capabilities and accuracy of the large Plus•X instruments but trades off battery capacity and many additional sensor channels in favour of reduced weight and size.

The Minos•X is equipped with one primary Xchange™ sensor port (i.e. conductivity or sound speed) and two secondary Xchange™ sensor ports (i.e. temperature and pressure). One additional digital port or two additional analog ports can be added by the factory, if required.

The Minos•X is capable of logging continuously for 19 hours with a full battery charge. The actual life varies somewhat depending on the sensors installed. Sampling rates are programmable by time (25 Hz to every 24 hours), by pressure (0.1 dbar or greater increments) or by sound speed (0.1 m/s or greater increments). When logging at time intervals of 25 seconds or more, the Minos•X powers down between samples to conserve the batteries.

Communications with the Minos•X are accomplished with RS-232 or RS-485. The instrument can be powered both internally and externally.

Which Manual Do I Start With?

AML Oceanographic's Xchange™ instruments are shipped with several manuals on the CD:

- An instrument manual (ie. This Minos•X manual) which provides an overview on how to use and maintain the instrument;
- A software manual (ie. SeaCast) which provides instructions on how to use the software to configure the instrument and review instrument data;
- Xchange™ sensor manuals (C•Xchange™, SV•Xchange™, P•Xchange™, T•Xchange™ and Turbidity•Xchange™) which provide overviews on how to install and maintain each of the Xchange™ sensors;

If you are configuring an instrument for field use or lab test, we recommend that you begin with the software (SeaCast) manual.

If you are focussed on instrument maintenance, we recommend that you begin with the instrument manual.

If you are wishing to swap an Xchange™ sensor, we recommend that you read the appropriate Xchange™ manual.

Shipping & Receiving

Receiving an Instrument

When an instrument is received at a new location it is prudent to perform the following steps to ensure the instrument is capable of performing when required.

- Check the shipping container for signs of damage. This could indicate damage to the instrument inside.
- The shipping package should include all of the following items
    - Minos•X instrument
    - Data/Power cable
    - Red shorting plug
    - Black dummy plug
    - One primary sensor blanking plug
    - Two secondary sensor blanking plugs
    - CD with manuals and documentation
    - Battery charger
- Check for damage
    - Check the cable for slices or gouges
    - Check the connector sockets for corrosion, dirt and salt deposits
    - Check the pressure case for dents and scrapes
    - Check the sensors for cracks or bends
- Check all the Xchange™ sensors are installed tightly. The blue retaining ring should be within 1 mm of the instrument end cap.
- Connect the instrument to a computer with the data cable and perform a scan or monitor if using SeaCast. Check the battery voltage on the output (normally the last column of data unless calculated parameters have been enabled). It should be between 7.2 and 8.4 volts.

Returning an Instrument to the Factory

- If shipping for repair or recalibration obtain an RMA number from the service centre.
- Perform all the steps listed above for Receiving
- Pack the instrument in its original shipping box, if possible, to prevent damage during shipping

An RMA number can be requested using any of the following contact options:

Service Department:
Email: service@AMLoceanographic.com
Phone: 1-250-656-0771
Fax: 1-250-655-3655

Website:
http://www.AMLoceanographic.com

Customer Portal:
RMA requests may also be submitted through the customer portal on the AML Oceanographic website.

To access the Customer Portal, please click on the Client Service & Support button, located on the left hand side of the AML Oceanographic home page.

Mailing and Shipping Address:
AML Oceanographic.
2071 Malaview Ave.
Sidney, BC, Canada
V8L 5X6

Using the Instrument

Pressure Ratings

Pressure ratings are given for both the P•Xchange™ and Turbidity•Xchange™ sensors and the entire instrument. **Deployments should never exceed the lower of these two pressure ratings.** For example, a 500m instrument equipped with a 6000 dBar (0-6000m) P•Xchange™ sensor is limited to deployments of 500m depth or less. Similarly, a 6000m instrument equipped with a 500 dBar (0-500m) P•Xchange™ sensor is also limited to deployments of 500m depth or less.

It is desirable to optimize the accuracy of pressure measurements by using a P•Xchange™ sensor with a pressure range that closely matches the depth of the deployment.

Caution: Do not exceed the specified pressure ratings of the P•Xchange™ sensor, Turbidity•Xchange™ sensor or the instrument housing. Overpressure can result in damage to the sensors and the instrument. Turbidity•Xchange™ sensors are limited to deployments of 500m depth or less.

Pre-Deployment Procedures

- 4 to 6 weeks ahead
  - Use the receiving steps above to verify the instrument is in good working order.
  - Verify the calibrations of all sensors are valid for the duration of the deployment. If not, swap the Xchange™ sensors for sensors with valid calibrations or send the Xchange™ sensors to a service center for recalibration.
  - Lightly lubricate the connectors with 3M silicone spray or equivalent.
- Before leaving the jetty
  - Verify the P•Xchange™ pressure range is appropriate for the depth of the deployment.
  - Connect the instrument to a computer using the data cable.
  - Check the instrument memory
    - Save any unsaved memory files
    - Initialize the memory using SeaCast or the 'INIT' command.

Caution: Install blanking plugs in all unused sensor ports prior to deployment. Failure to install blanking plugs will result in damage to the connectors.

C•Xchange™ & SV•Xchange™ blanking plug

T•Xchange™ & P•Xchange™ Turbidity•Xchange™ blanking plug

Supported Sensor Configurations

Minos•X with cage removed and blanking plugs installed. Minos•X have one primary and two secondary sensor port types (abbreviated as P1S2) that allow for a number of sensor combinations.

Supported Sensor Configurations

Swappable sensors allow you to configure your instrument in a number of different ways. Your Minos•X supports the following sensor combinations. Note that not all supported sensor combinations are shown. It is possible, for example, to install two T•Xchange™ sensors, or two P•Xchange™ sensors simultaneously for cross verification.

Configuration	Primary Port	Secondary Ports*	
1	SV	T	P
2	SV	T	Turbidity
3	SV	P	Turbidity
4	C	T	P

*Note: T, P and Turbidity•Xchange™ sensors can be installed in either secondary port on Minos•X

Understanding the LED indicator

The LED indicator is located next to the data/power connector on the instrument top endcap.

- The LED indicator will be on whenever the data/power cable is plugged into the instrument.
- The LED indicator will turn on when the red shorting plug is inserted into the instrument. It will turn off after 5 minutes to conserve power.
- When the instrument is logging and is brought back to the surface the LED indicator will resume for 5 minutes so that the operator can see that the instrument is still functioning after the cast.

The LED indicator displays are as follows:

- LED is a constant green. This indicates the instrument is on and the battery has more than 20% capacity remaining.
- LED is flashing green. The instrument is logging data and the battery has more than 20% capacity remaining.
  Notes:
  - The flashing green LED will turn off after 5 minutes to conserve power.
  - The instrument will not start logging until it is immersed in water and it takes its first sample at the programmed sampling rate.
- LED is a constant red. This indicates the instrument is on and the battery has less than 20% capacity remaining.
- LED is flashing red. The instrument is logging data and the battery has less than 20% capacity remaining.
  Notes:
  - The flashing red LED will turn off after 5 minutes to conserve power.
  - The instrument will not start logging until it is immersed in water and it takes its first sample at the programmed sampling rate.
- LED off with data/power cable attached. The instrument is not working properly. Consult the troubleshooting section or call the service department.
- LED off with the red shorting plug inserted. If the shorting plug was inserted less than 5 minutes ago the instrument is not working properly. Consult the troubleshooting section or call the service department. If the LED was on for the first 5 minutes after inserting the shorting plug the instrument is functioning correctly and the LED has turned off to conserve power.

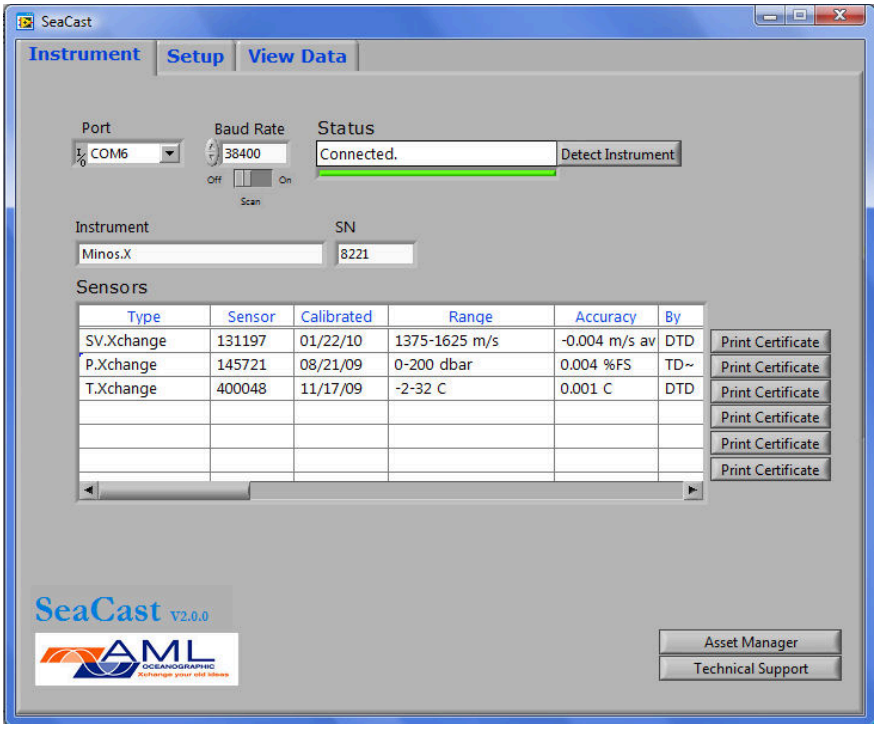
Configuring Sampling Parameters using SeaCast

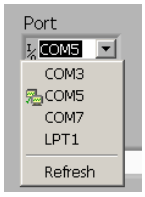
AML Oceanographic' SeaCast application software greatly simplifies the process of setting up an instrument to complete a profile.

Full details on the instrument configuration process can be found in the SeaCast manual. Below please find a quick summary of that process:

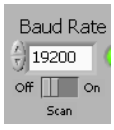
Selecting an Instrument for Configuration

On the Instrument Tab, the first row of fields 'Port', 'Baud Rate' and 'Status' control and display the communications with the instrument.





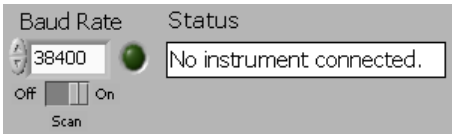
The 'Port' field allows the user to select the computer communications port to which the instrument is connected. If uncertain about the port the user can check the ports in the Device Manager or Hardware Manager found in the control panel in the Windows operating system. The 'Refresh' selection at the bottom of the list allows the user to force a new detection of available ports. This is useful if a USB connection is made after SeaCast is launched.



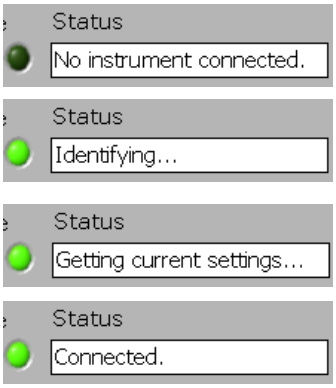
The 'Baud Rate' field is used to select the baud rate the user wishes to use while communicating to the instrument. Lower baud rates allow longer cables to be used if using RS-232/485/422. Higher baud rates shorten the data transfer times. Choose 38,400 baud whenever possible.

If an instrument is set to autobaud (default setting) it will detect the baud rate chosen in SeaCast and communicate at that baud rate. If the baud rate is changed in SeaCast then power to the instrument must be cycled to re-establish communications at the new baud rate.

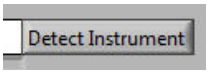
Some instruments are set up to communicate at fixed baud rates. In this case the baud rate in SeaCast must be set to the same baud rate as the instrument. If the instrument baud rate is unknown, the 'Scan' switch below the 'Baud Rate' field can be used to have SeaCast cycle through all the baud rates to try to detect the instrument baud rate.



The "Status" field shows the status of the communications with the instrument. The green light indicates that communications have been established with the instrument. During the identification process, SeaCast is determining the type and serial number of the instrument and any connected sensors. During the settings process, SeaCast is determining the latest sampling and logging settings that were programmed into the instrument. When all the required handshaking has been completed, the 'Status' field will show "Connected" and the user may now use the instrument. Please note that the handshaking can take up to 30 seconds to complete.

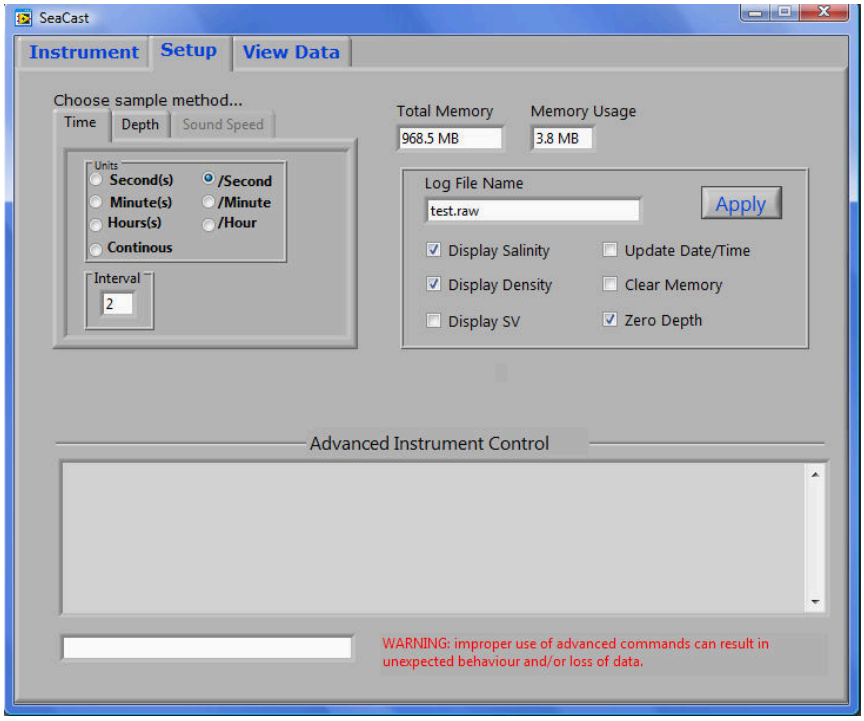


The Detect Instrument button forces SeaCast to re-detect and re-identify the instrument and its sensors.



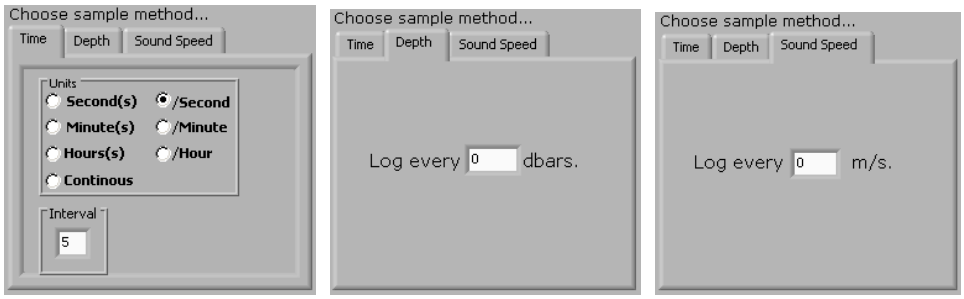
Configuring the Selected Instrument

After the instrument has been detected by SeaCast, select the Setup tab at the top of the SeaCast window.



The box in the upper left of the Setup page controls the sampling of the instrument. There are three sampling methods available:

- Sampling by Time Interval (ie. sample 25 times per second, 10 times per hour, every 5 seconds, etc.)
- Sampling by Depth Interval (ie. 1 sample every 1 dbar, 1 sample every 20 dbars, etc.) This option is only available when a Pressure•Xchange™ sensor is installed in the instrument.
- Sampling by Sound Velocity Interval (ie. 1 sample every time sound velocity changes by more than 1 m/s, 1 sample every time sound velocity changes by more than 4 m/s, etc.) This option is only available when a Sound Velocity•Xchange™ sensor is installed in the instrument.



Sampling Method Selection Tab

SeaCast will allow the user to use only one sampling method at a time. Thus, if 5 samples per second is chosen, as shown above, the depth and sound velocity increments are zeroed. This prevents conflicting sampling requirements from being programmed into the instrument.

Instrument time, memory & log file settings

The memory fields show the size of the memory installed on the instrument and the percentage of the memory that has been used. The 'Clear Memory' check box allows the user to erase the entire memory. A pop up warning window will be displayed if this check box is selected.

The 'Log File Name' field displays the current log file name that data will be logged to in the instrument memory. The instrument log file name is limited to 8 characters plus 3 characters for the file extension. For example, data.txt, profile1.raw, or april.dat. Please note this is the log file in the instrument not the export file for SeaCast.

The 'Update Date/Time' check box will synchronize the instrument clock to the computer's clock.

Configuring Sampling Parameters with HyperTerminal

Instruments can also be configured for deployment using HyperTerminal or other terminal emulation programs. As with SeaCast, communications with the instrument must be established using the correct communications port and settings. The communications settings are 8 data bits, 1 stop bit, no parity, no flow control and the desired baud rate.

The following steps must be completed by issuing text commands.

Step	Possible Commands
Initialize Memory (erases instrument memory)	INIT
Set Log File Name	SET LOG filename.txt
Set Instrument Time & Date	SET TIME hh:mm:ss SET DATE mm/dd/yy
Set Sampling Parameters	SET SAMPLE RATE CONTINUOUS SET SAMPLE RATE 5/s SET P INC 1 SET SOUND INC 2

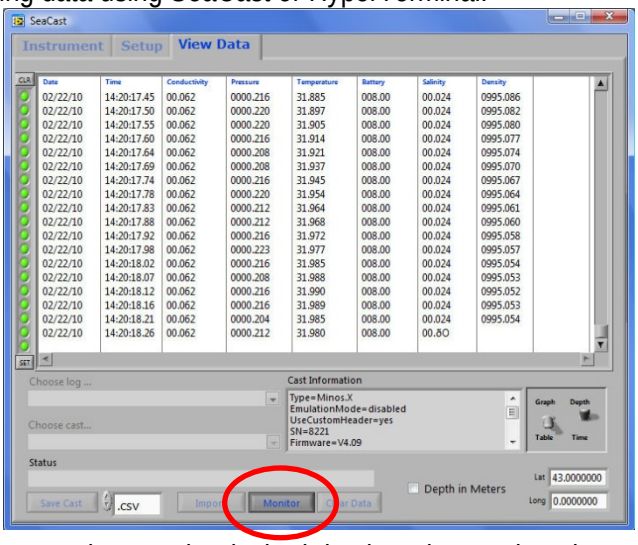
Please consult the Commands section of the Appendix for full syntax details on how to issue the commands in question. Please note that the above table provides example commands only; many additional sampling regimes can be established.

Logging a Profile

- Ensure the pre-deployment procedures have been completed (see Page 6).
- Plug the data/power cable into the instrument.
- Ensure that the desired sampling requirements have been selected and applied.
- With the instrument in air, use the zero command to zero the barometric pressure offset.
- Insert the red shorting plug to power the instrument. Insertion of the shorting plug tells the instrument to begin logging data once it is submerged. The instrument determines whether or not it is submerged by looking for valid conductivity or sound speed readings.
    - The green LED light should illuminate on the top of the instrument indicating the battery has more than 20% capacity remaining and the instrument is ready to start logging.
    - If the LED light is red the battery charge is less than 20% but the instrument is still ready to log.
    - If the LED light fails to illuminate the instrument will not log. Refer to the troubleshooting section of this manual if this occurs.
- Securely attach the lowering cable to the instrument shackle bar.
- Lower the instrument until it is just submerged. Keep the instrument at this depth for 2 minutes prior to beginning the cast. This allows the sensors time to wet and the pressure case to shed heat.
- Send the instrument down to the desired depth and return it to the surface.
- Note that with the Minos•X in the typical, vertical orientation, the downcast is usually more accurate than the upcast data since the downcast measurements are not contaminated by the thermal shedding from the pressure case.

Monitoring Real Time Data

- Ensure the pre-deployment procedures have been done (see Page 6).
- Ensure that the desired sampling requirements have been selected and applied.
- Plug the data/power cable into the instrument. If you power the instrument externally over a long cable, please note the following:
    - The longer the cable the higher the voltage drop on the cable. The voltage drop on a standard AML cable, with a standard Minos•X, is about 2 volts per 100m of cable while sampling and 0 volts per 100m when in low power mode.
    - The instrument's low voltage warning has a default level of 7.2 volts.
    - The instrument's auto shutdown voltage has a default level of 6.5 volts.
    - The instrument's maximum voltage is 26 volts.
    - The voltage at the instrument, while sampling, must be above the shutdown level for the instrument to operate.
- With the instrument in air, use the zero command to zero the barometric pressure offset.
- Securely attach the lowering cable to the instrument shackle bar.
- Lower the instrument until it is just submerged. Keep the instrument at this depth for 2 minutes prior to beginning the cast. This allows the sensors time to wet and the pressure case to shed heat.
- Begin monitoring data using SeaCast or HyperTerminal.



- Send the instrument down to the desired depth and return it to the surface.
- Note that with the Minos•X in the typical, vertical orientation, the downcast is usually more accurate than the upcast data since the downcast measurements are not contaminated by the thermal shedding from the pressure case.

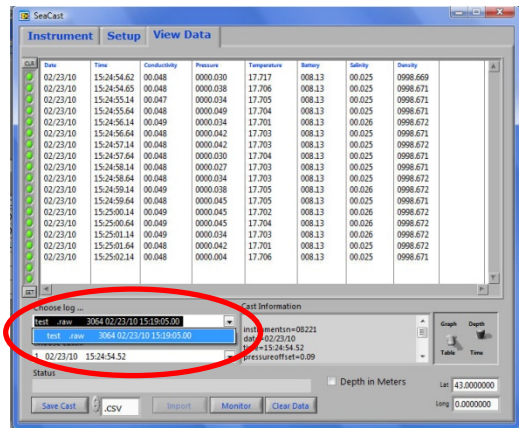
Post-Deployment Procedures

- When the instrument is pulled from the water it should be rinsed in fresh water.
- Dry the area around the connectors with a clean cloth or compressed air prior to disconnecting the plugs or cables. Do not blow compressed air into the Pressure•Xchange™ sensor.
- Remove the shorting plug or cable. Place dummy plug in the connector to protect it.
- Dry the instrument and stow it securely.

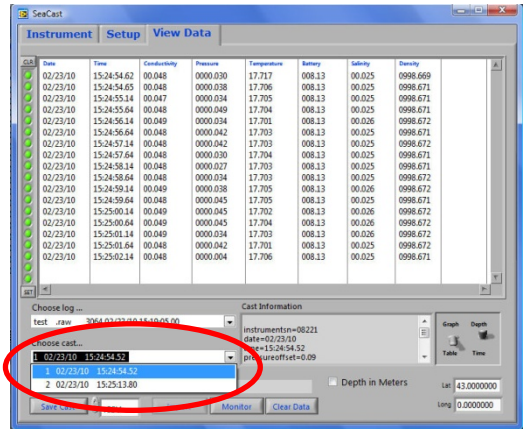
Viewing your Data

You may download and view data using SeaCast or HyperTerminal. To download and review data:

- Connect the instrument to the computer using the data/power cable
- Download the files to the computer:
  - With SeaCast, use the **Choose Log File** and **Choose Cast** fields to retrieve the cast of interest



Choose log file



Choose cast

  - With HyperTerminal, use the DIR command to list all the files on memory, use the DUMP command to retrieve the file of interest. For example:

```
Minos.X Version 4.09 SN:8221
AML Oceanographic Ltd.
968.5 MBytes installed

>dir

test    .raw       5598 02/24/10 14:41:55.00
data    .txt       3987 02/24/10 14:45:08.00

 960 MBytes free
   7 MBytes Used
   2 File(s) listed
>dump data.txt
[cast header]
InstrumentSN=08221
Date=02/24/10
Time=14:45:10.55
PressureOffset=0.09
UsePressureOffset=yes
Slot1Sensor1=SV-C.Xchange SV.X SN 131197 01/22/10
Slot2Sensor1=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09

[Data]
02/24/10 14:45:10.66  1474.313  0000.015  17.447  008.18  00.034  0998.724
02/24/10 14:45:10.69  1474.334  0000.015  17.449  008.20  00.046  0998.733
02/24/10 14:45:11.19  1474.332  0000.027  17.451  008.20  00.037  0998.726
02/24/10 14:45:11.69  1474.326  0000.027  17.451  008.20  00.032  0998.722
02/24/10 14:45:12.19  1474.319  0000.027  17.457  008.20  00.011  0998.705
02/24/10 14:45:12.69  1474.321  0000.034  17.459  008.20  00.005  0998.700
02/24/10 14:45:13.19  1474.318  0000.023  17.457  008.20  00.008  0998.702
```

```
02/24/10 14:45:13.69  1474.321  0000.019  17.458  008.20  00.010  0998.704
02/24/10 14:45:14.19  1474.427  0000.019  17.459  008.20  00.100  0998.773
02/24/10 14:45:14.69  0000.000 -0000.015  17.601  008.20  00.000  0000.000
02/24/10 14:45:15.19  0000.000 -0000.030  17.655  008.20  00.000  0000.000
02/24/10 14:45:15.69  0000.000 -0000.011  17.651  008.20  00.000  0000.000
02/24/10 14:45:16.19  0000.000 -0000.015  17.632  008.20  00.000  0000.000
02/24/10 14:45:16.69  0000.000 -0000.015  17.624  008.20  00.000  0000.000
02/24/10 14:45:17.19  0000.000 -0000.015  17.622  008.20  00.000  0000.000
02/24/10 14:45:17.69  0000.000 -0000.015  17.618  008.20  00.000  0000.000
[cast header]
InstrumentSN=08221
Date=02/24/10
Time=14:45:21.85
PressureOffset=0.09
UsePressureOffset=yes
Slot1Sensor1=SV-C.Xchange SV.X SN 131197 01/22/10
Slot2Sensor1=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09

[Data]
02/24/10 14:45:21.92  1474.309 -0000.019  17.598  008.20  00.000  0998.671
02/24/10 14:45:21.95  1474.308  0000.019  17.451  008.20  00.017  0998.711
02/24/10 14:45:22.44  1474.301  0000.023  17.453  008.20  00.005  0998.701
02/24/10 14:45:22.94  1474.297  0000.011  17.453  008.20  00.003  0998.699
02/24/10 14:45:23.44  1474.294  0000.019  17.451  008.20  00.005  0998.702
02/24/10 14:45:23.94  1474.314  0000.019  17.453  008.20  00.019  0998.711
02/24/10 14:45:24.44  1474.310  0000.027  17.453  008.20  00.015  0998.709
02/24/10 14:45:24.94  1474.307  0000.015  17.451  008.20  00.016  0998.709
02/24/10 14:45:25.44  1474.307  0000.027  17.453  008.20  00.009  0998.704
02/24/10 14:45:25.94  1474.308  0000.023  17.454  008.20  00.008  0998.703
02/24/10 14:45:26.44  1474.313  0000.023  17.451  008.20  00.021  0998.714
02/24/10 14:45:26.94  1474.294  0000.023  17.452  008.20  00.002  0998.699
02/24/10 14:45:27.44  1474.313  0000.023  17.453  008.20  00.015  0998.709
02/24/10 14:45:27.94  1474.303  0000.023  17.454  008.20  00.004  0998.700
02/24/10 14:45:28.44  1474.312  0000.023  17.453  008.20  00.015  0998.708
02/24/10 14:45:28.94  1474.319  0000.030  17.453  008.20  00.019  0998.712
02/24/10 14:45:29.44  1474.336  0000.027  17.450  008.20  00.045  0998.732
02/24/10 14:45:29.94  1474.314  0000.027  17.450  008.20  00.023  0998.715
02/24/10 14:45:30.44  1474.326  0000.027  17.451  008.20  00.032  0998.722
02/24/10 14:45:30.94  1474.320  0000.027  17.451  008.20  00.027  0998.718
02/24/10 14:45:31.44  1474.305  0000.023  17.454  008.20  00.006  0998.701
02/24/10 14:45:31.94  1474.312  0000.030  17.451  008.20  00.020  0998.713
02/24/10 14:45:32.44  1474.311  0000.034  17.453  008.20  00.014  0998.708
02/24/10 14:45:32.94  1474.312  0000.030  17.450  008.20  00.021  0998.714
02/24/10 14:45:33.44  0000.000 -0000.011  17.459  008.20  00.000  0000.000
02/24/10 14:45:33.94  0000.000 -0000.019  17.569  008.20  00.000  0000.000
02/24/10 14:45:34.44  0000.000 -0000.015  17.548  008.20  00.000  0000.000
02/24/10 14:45:34.94  0000.000 -0000.023  17.515  008.20  00.000  0000.000
02/24/10 14:45:35.44  0000.000 -0000.015  17.498  008.20  00.000  0000.000
02/24/10 14:45:35.94  0000.000 -0000.023  17.487  008.20  00.000  0000.000
02/24/10 14:45:36.44  0000.000 -0000.019  17.485  008.20  00.000  0000.000
>
```

Configuring the Instrument for Data on Power Up

Perform the following steps:

- Open a terminal emulation program, such as HyperTerminal, and ensure the serial port has been selected in the program. If the instrument has been set to a specific baud rate with the SET DETECT command the terminal emulation program must be configured for that baud rate.
- Connect the instrument to the computer using the data/power cable supplied with the instrument.
- Using the terminal emulation program issue the following commands to the instrument:
    - SET STARTUP NOHEADER (disables the power up header information)
    - SET STARTUP MONITOR (enable data output on power up)
    - SET SAMPLE RATE 10/S (set the desired sampling rate)
    - SET DETECT 07 (set fixed 38400 baudrate)

      Note details on the SET DETECT command can be found in the appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.
- Plug the data/power cable into the instrument to turn the instrument on.

Disabling Data on Power Up

Perform the following steps:

- Open a terminal emulation program, such as HyperTerminal, and ensure the serial port has been selected in the program. If the instrument has been set to a specific baud rate with the SET DETECT command the terminal emulation program must be configured for that baud rate.
- Connect the instrument to the computer using the data/power cable supplied with the instrument. Instrument data will stream through the terminal emulation program window.
- Unplug the data/power cable from the instrument to turn the instrument off.
- Hold down < ENTER >
- Plug the data/power cable into the instrument to turn the instrument on.
- Release the <ENTER> key once the prompt '>' is displayed.
- Using the terminal emulation program issue the following commands to disable data on powerup:
    - SET STARTUP HEADER (enables the power up header information)
    - SET STARTUP PROMPT (disable data output on power up)
    - SET SAMPLE RATE 10/S (selects the desired sampling rate)
    - SET DETECT A7 (set 10 autobaud attempts then default to 38400 baud)

      Note details on the SET DETECT command can be found in the appendix.
- Unplug the data/power cable from the instrument to turn the instrument off.

Maintaining the Instrument

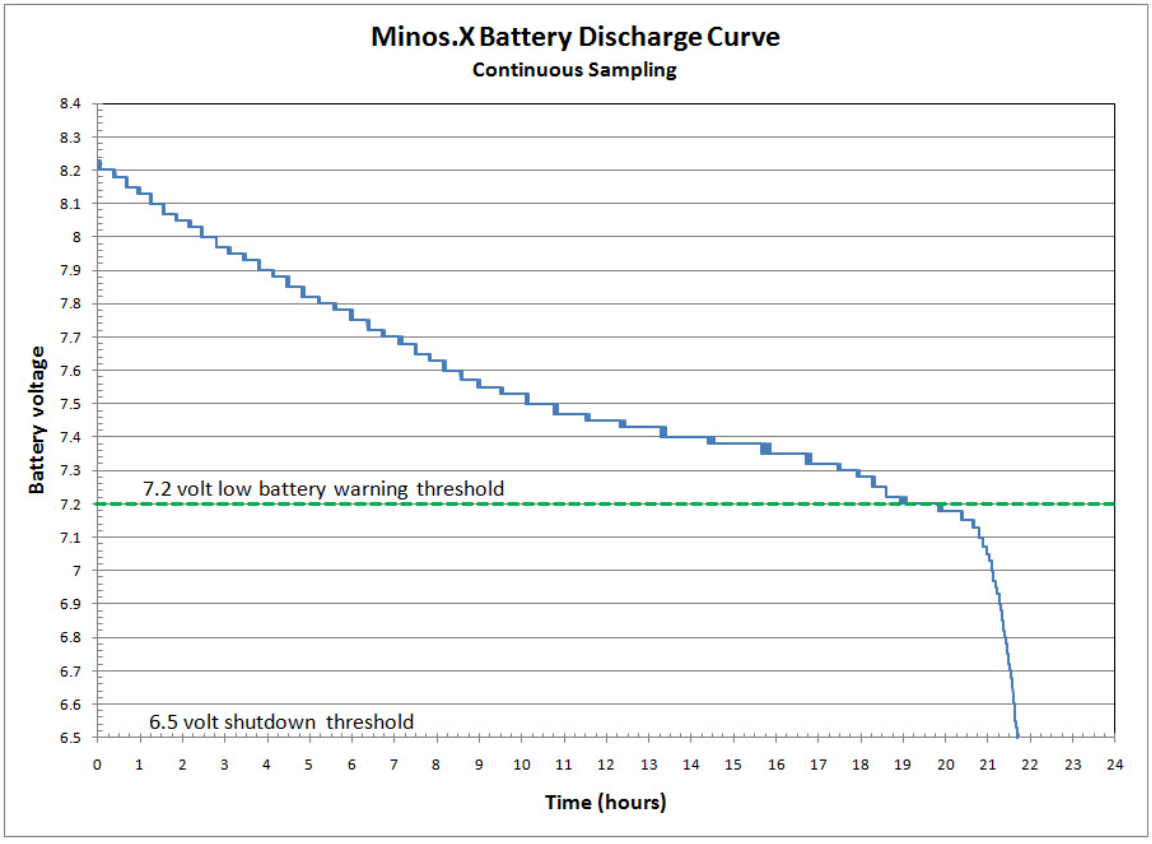
Battery Care

Incorrect care can reduce the life of the batteries. Below are some guidelines to prevent damage to the batteries.

- Do not leave the data cable installed in the instrument. This turns the instrument on and depletes the battery.
- Do not leave the red shorting plug installed. This turns the instrument on and depletes the battery.
- Before storing the instrument for several months charge the battery to at least 7.3 volts (40% capacity). The battery will self discharge at a rate of 2% per month so extended storage durations can require recharging to protect the battery from fully depleting.

Battery Life

The 5.3 Amp hour, 7.2 volt, lithium ion battery pack will power the instrument for approximately 19 hours of continuous use. The discharge curve for the instrument is shown below.



Charging the Lithium-Ion Batteries

- Ensure the instrument is dry.
- Plug the data cable into the instrument.
- Plug the charger into the data cable.
- Plug the charger into a 120 or 240 volt AC outlet and allow the instrument to charge until the red charging light on the charger turns green. A full charge requires approximately 5 hours, however, the battery will reach 80% capacity within 2 hours.

> The charger should be connected to the battery before plugging the charger into the AC outlet for proper operation of the charger and charging light.

- It is best to turn the instrument off to maintain a full charge after charging. Do this by unplugging the data power cable from the instrument.
- If instrument is left turned on after the charger has charged the battery to 8.3 volts the charger will turn off and the instrument will start drawing on the battery. When the battery voltage drops below 8 volts the charger will automatically turn on and start charging the battery up to 8.3 volts. The charger can be restarted by manually resetting the charger (refer to procedure below).
- It is possible to use the instrument while charging the battery however, instrument use causes the power consumption to fluctuate which can confuse the charger and cause it to stop charging prematurely. The charger monitors the charging power to detect when the battery is charged; fluctuating power from the instrument can corrupt the algorithm. To ensure proper charging, manually reset the charger when you have stopped using the instrument (refer to procedure below).
- To manually reset the charger: unplug the charger from the wall and plug the charger back in. This will reset the charger and start charging the battery.

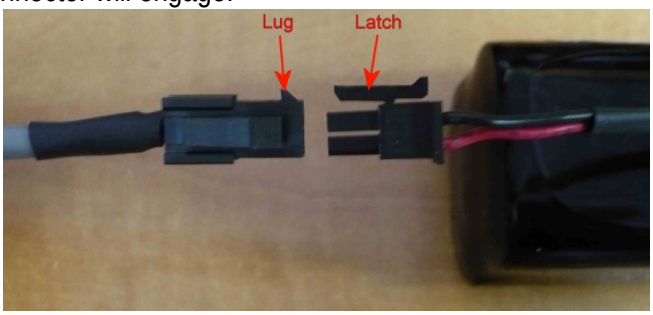
Changing the Lithium-Ion Battery Pack

It is sometimes more efficient to swap a depleted battery pack with a charged battery. To facilitate this, a spare battery and charge connector can be ordered with the product code CSE-0013.

CSE-0013 - Spare battery and charge connector

To change the battery pack:

- Charge the spare battery.
  - Plug the charge connector into the battery. Ensure the correct polarity! The latch on the connector will engage.



  - Plug the charger into the charge connector.
  - Plug the charger into a 120 or 240 volt AC outlet and allow the instrument to charge until the red charging light on the charger turns green. A full charge requires approximately 5 hours, however, the battery will reach 80% capacity within 2 hours.

The charger should be connected to the battery before plugging the charger into the AC outlet for proper operation of the charger and charging light.

Charging the spare battery

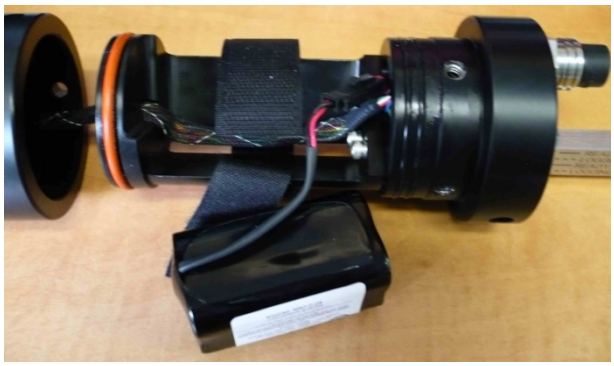
- Dry the instrument.
- Open the battery compartment on the instrument.
  - Remove the four ¼x20 set screws in the instrument using a 1/8th inch hex driver.

  - Grasp the shackle bar and slowly wiggle the end cap out of the instrument until it reaches the soft stop.

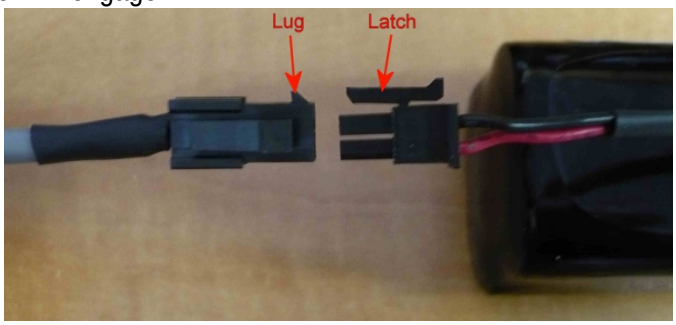
Do not twist or attempt to unscrew the endcap, this will twist the internal cable harness and can damage the wires.

  - Slowly pull the battery compartment just clear of the instrument.

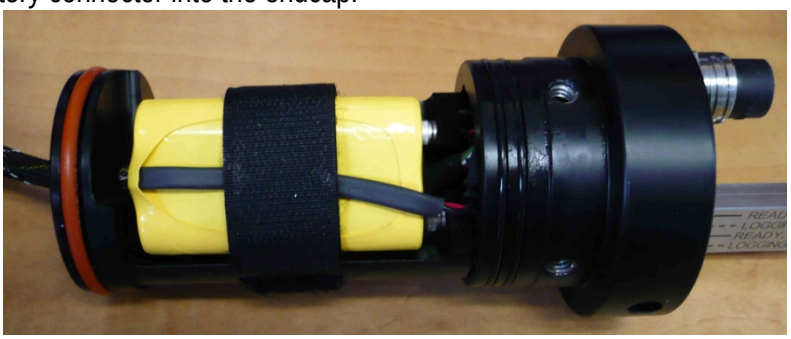
  - Undo the Velcro retainer, remove the battery pack and disconnect the battery connector.



- Connect the new battery connector. Ensure the correct polarity! The latch on the connector will engage.



- Place the battery pack into the holder and secure the Velcro strap. Tuck the battery connector into the endcap.



- Re-insert the endcap into the instrument. Do not twist the endcap more than ¼ turn each way. Excessive twisting of the endcap will damage the internal wiring of the instrument.
- Replace the four ¼x20 set screws.
- Connect the instrument to a computer perform a scan and check the battery voltage. A fully charged battery will be approximately 8.3 volts.

Periodic Maintenance

Periodic maintenance will prolong the life of the instrument. The following is recommended:

- If the instrument is very dirty or oily use warm soapy water and allow the instrument to soak before cleaning with a rag or soft brush. Rinse with fresh water.
- Before each use
  - Check the battery voltage (a fully charged battery will be approximately 8.3 volts, a low battery will be less than 7.2 volts)
  - Check the tightness of swappable sensors
  - Check for nicks and cuts on the cable
- After each use
  - Clean and rinse the instrument using fresh water
  - Dry and safely store the instrument
  - Partially charge the batteries if storing the instrument for long periods

- Monthly
  - Lightly lubricate the connector contacts with 3M silicone spray or equivalent
- Yearly
  - Send the instrument or Xchange™ sensors to a service centre for diagnostics and re-calibration

Communications

PC Settings

The Minos•X will communicate with both RS-232 and RS-485 serial connections. The computer to which the instrument is connected must be set up as follows:

- 8 bits
- 1 stop bit
- No parity
- No hardware handshaking
- Baud rate of 600, 1200, 2400, 4800, 9600, 19,200 or 38,400 baud

After power up, the Minos•X will wait for an ASCII carriage return. The instrument will automatically detect whether communications are RS-232 or RS-485 as well as the baud rate.

Output Formats

Output formats can be modified by the user. If the modifications required are not supported by the commonly used command list in the next section, please contact the factory and we will support your requirements.

The user can change:

- The number of decimal places for each channel
- Turn on or off
    - date and time
    - calculated parameters
    - battery voltage
    - power up information (header)
    - automatic monitoring on power up

Default output format

The output from the Minos•X is space separated values. There are commands to change the delimiter to tab or comma separated values if required. Example default data channel outputs with all calculated parameters turned on are:

SV,P,T sensors

Date	Time	Sound velocity	Pressure	Temperature	Battery	Density	Salinity
mm/dd/yy	hh:mm:ss.ss	m/s	dbar	C	volts	kg/m^3	ppt

SV,P,Turbidity sensors

Date	Time	Sound velocity	Pressure	Turbidity	Battery
mm/dd/yy	hh:mm:ss.ss	m/s	dbar	NTU	volts

C,P,T sensors

Date	Time	Conductivity	Pressure	Temperature	Battery	Density	Salinity	Sound velocity
mm/dd/yy	hh:mm:ss.ss	mS/cm	dbar	C	volts	kg/m^3	ppt	m/s

Example outputs:
User inputs in the output capture shown below are in bold type.

```
Minos.X Version 4.09 SN:8221
AML Oceanographic Ltd.
968.5 MBytes installed

>scan
02/24/10 14:59:20.90  1474.372  0000.098  17.470  008.15  00.018  0998.708
>monitor
02/24/10 14:59:25.10  1474.374  0000.102  17.472  008.18  00.014  0998.705
02/24/10 14:59:25.60  1474.354  0000.106  17.474  008.18  00.000  0998.694
02/24/10 14:59:26.10  1474.386  0000.110  17.474  008.18  00.018  0998.708
02/24/10 14:59:26.60  1474.374  0000.102  17.473  008.18  00.010  0998.702
>dis options
[Instrument]
Type=Minos.X
EmulationMode=disabled
UseCustomHeader=yes
SN=8221
Firmware=V4.09
SampleUnits=/ second
SampleInterval=2
PressureInc=0.00
SoundInc=0.00
LogFile=data.txt
Date=02/24/10
Time=14:59:36
MemorySize=968.5 MB
MemoryUsed=7.6 MB
DisplayTime=yes
DisplayDate=yes
DisplaySalinity=yes
DisplayDensity=yes
DisplaySoundVelocity=no
DisplayBattery=yes
RelayMode=auto detection
RealtimeLogging=no
LoggingTimeout=0
StartupDelay=10
DisplayHeader=yes
StartupMode=prompt
CharacterReception=yes
LoggingBreakMode=no
DetectionMode=A5
BatteryACoefficient=+3.500000E-01
BatteryBCoefficient=+2.500000E-02
ShutDownVoltage=6.5
WarningVoltage=7.2
PressureOffset=0.00
UsePressureOffset=no
SoundVelocityThreshold=1375.00
DelimterMode=Space
SensorDetectionMode=Once
Traceability=yes
SkipPowerOff=no

[Slot 1]
SensorName=SV-C.Xchange SV.X SN 131197 01/22/10
BoardSN=65535
```

```
[Slot 2]
SensorName=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09
BoardSN=65535
>dir

test    .raw       5598 02/24/10 14:41:55.00
data    .txt       3987 02/24/10 14:45:08.00

 960 MBytes free
   7 MBytes Used
   2 File(s) listed
>dump data.txt
[cast header]
InstrumentSN=08221
Date=02/24/10
Time=14:45:10.55
PressureOffset=0.09
UsePressureOffset=yes
Slot1Sensor1=SV-C.Xchange SV.X SN 131197 01/22/10
Slot2Sensor1=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09

[Data]
02/24/10 14:45:10.66  1474.313  0000.015  17.447  008.18  00.034  0998.724
02/24/10 14:45:10.69  1474.334  0000.015  17.449  008.20  00.046  0998.733
02/24/10 14:45:11.19  1474.332  0000.027  17.451  008.20  00.037  0998.726
02/24/10 14:45:11.69  1474.326  0000.027  17.451  008.20  00.032  0998.722
02/24/10 14:45:12.19  1474.319  0000.027  17.457  008.20  00.011  0998.705
02/24/10 14:45:12.69  1474.321  0000.034  17.459  008.20  00.005  0998.700
02/24/10 14:45:13.19  1474.318  0000.023  17.457  008.20  00.008  0998.702
02/24/10 14:45:13.69  1474.321  0000.019  17.458  008.20  00.010  0998.704
02/24/10 14:45:14.19  1474.427  0000.019  17.459  008.20  00.100  0998.773
02/24/10 14:45:14.69  0000.000 -0000.015  17.601  008.20  00.000  0000.000
02/24/10 14:45:15.19  0000.000 -0000.030  17.655  008.20  00.000  0000.000
02/24/10 14:45:15.69  0000.000 -0000.011  17.651  008.20  00.000  0000.000
02/24/10 14:45:16.19  0000.000 -0000.015  17.632  008.20  00.000  0000.000
02/24/10 14:45:16.69  0000.000 -0000.015  17.624  008.20  00.000  0000.000
02/24/10 14:45:17.19  0000.000 -0000.015  17.622  008.20  00.000  0000.000
02/24/10 14:45:17.69  0000.000 -0000.015  17.618  008.20  00.000  0000.000
[cast header]
InstrumentSN=08221
Date=02/24/10
Time=14:45:21.85
PressureOffset=0.09
UsePressureOffset=yes
Slot1Sensor1=SV-C.Xchange SV.X SN 131197 01/22/10
Slot2Sensor1=P-T.Xchange P.X SN 145721 08/21/09 T.X SN 400048 11/17/09

[Data]
02/24/10 14:45:21.92  1474.309 -0000.019  17.598  008.20  00.000  0998.671
02/24/10 14:45:21.95  1474.308  0000.019  17.451  008.20  00.017  0998.711
02/24/10 14:45:22.44  1474.301  0000.023  17.453  008.20  00.005  0998.701
02/24/10 14:45:22.94  1474.297  0000.011  17.453  008.20  00.003  0998.699
02/24/10 14:45:23.44  1474.294  0000.019  17.451  008.20  00.005  0998.702
02/24/10 14:45:23.94  1474.314  0000.019  17.453  008.20  00.019  0998.711
02/24/10 14:45:24.44  1474.310  0000.027  17.453  008.20  00.015  0998.709
02/24/10 14:45:24.94  1474.307  0000.015  17.451  008.20  00.016  0998.709
02/24/10 14:45:25.44  1474.307  0000.027  17.453  008.20  00.009  0998.704
02/24/10 14:45:25.94  1474.308  0000.023  17.454  008.20  00.008  0998.703
02/24/10 14:45:26.44  1474.313  0000.023  17.451  008.20  00.021  0998.714
02/24/10 14:45:26.94  1474.294  0000.023  17.452  008.20  00.002  0998.699
02/24/10 14:45:27.44  1474.313  0000.023  17.453  008.20  00.015  0998.709
02/24/10 14:45:27.94  1474.303  0000.023  17.454  008.20  00.004  0998.700
```

```
02/24/10 14:45:28.44  1474.312  0000.023  17.453  008.20  00.015  0998.708
02/24/10 14:45:28.94  1474.319  0000.030  17.453  008.20  00.019  0998.712
02/24/10 14:45:29.44  1474.336  0000.027  17.450  008.20  00.045  0998.732
02/24/10 14:45:29.94  1474.314  0000.027  17.450  008.20  00.023  0998.715
02/24/10 14:45:30.44  1474.326  0000.027  17.451  008.20  00.032  0998.722
02/24/10 14:45:30.94  1474.320  0000.027  17.451  008.20  00.027  0998.718
02/24/10 14:45:31.44  1474.305  0000.023  17.454  008.20  00.006  0998.701
02/24/10 14:45:31.94  1474.312  0000.030  17.451  008.20  00.020  0998.713
02/24/10 14:45:32.44  1474.311  0000.034  17.453  008.20  00.014  0998.708
02/24/10 14:45:32.94  1474.312  0000.030  17.450  008.20  00.021  0998.714
02/24/10 14:45:33.44  0000.000 -0000.011  17.459  008.20  00.000  0000.000
02/24/10 14:45:33.94  0000.000 -0000.019  17.569  008.20  00.000  0000.000
02/24/10 14:45:34.44  0000.000 -0000.015  17.548  008.20  00.000  0000.000
02/24/10 14:45:34.94  0000.000 -0000.023  17.515  008.20  00.000  0000.000
02/24/10 14:45:35.44  0000.000 -0000.015  17.498  008.20  00.000  0000.000
02/24/10 14:45:35.94  0000.000 -0000.023  17.487  008.20  00.000  0000.000
02/24/10 14:45:36.44  0000.000 -0000.019  17.485  008.20  00.000  0000.000
>
```

Customer Support

Troubleshooting

Instrument fails to communicate:

- Check the cables
    - Is the data power cable connected to the instrument and computer?
    - If using a cable other than an AML cable, it should be configured as a null modem cable.
    - If using multiple cable lengths, the extensions should not be configured as null modem cables.
    - Are there any cuts in the cable?
- Are the batteries dead? Try using external power.
- If using external power over a long cable, check the voltage drop over the cable. Measure the voltage across a 10 watt, 27Ω, resistor across pins 1 and 4 of the cable. The voltage must be above 7 volts.
- Are the communication settings in the program used on the computer correct?
    - Comm port selection
    - 8 bits
    - 1 stop bit
    - No parity
    - No hardware handshaking
    - Baud rate between 600 and 38,400 baud
- Are the communication settings in the instrument correct?
    - Was the instrument specifically set to one baud rate last time? If so, the user must use that baud rate to resume communications.
    - Was the instrument set to only RS-232 or only RS-485 last time? If so, the user must resume communications in the required protocol.
    - Was the instrument set to RX OFF last time? If so, a carriage return must be sent to the instrument immediately after power is applied to interrupt this mode.
    - Was the instrument set to monitor on power up mode? If so, a carriage return must be sent to the instrument immediately after power is applied to interrupt this mode
- Is the connector damaged?

Instrument fails to log:

- Verify the LED indicator status:
    - With the instrument in air, insert the red shorting plug. The LED indicator should show solid green indicating the instrument is CHARGED and READY. (if neither a SV•Xchange™ or Conductivity•Xchange™ sensor is installed the instrument will begin logging in air)
    - Place the instrument sensors in water. The LED indicator should show flashing green indicating the instrument is CHARGED and LOGGING.
    - If the LED indicator shows red, charge the battery.
    - If the indicator does not light up then the instrument is not operating correctly, continue with the following troubleshooting items.

- Allow two sample periods for the instrument to detect that it is immersed.
- Was the red shorting plug firmly seated in the instrument?
- Are the batteries dead (LED light does not illuminate when shorting plug is installed)?
- Were the sound velocity increment, pressure increment and/or sample rate settings set to values preventing logging?
- Was the log file name set correctly?
- Is the connector damaged, dirty or corroded?
- Send an INIT command to the instrument to re-initialize the memory.

Instrument generates noisy or inaccurate data:

- Is the connector damaged, dirty or corroded?
- If connected to external power, is there noise on the power supply? Switching power supplies are common sources of noise.
- Nearby EMI sources such as electric motors can create noise. If possible move the instrument and its cables away from the noise source.
- Are there bubbles on the SV•Xchange™ sensor or in the Conductivity•Xchange™ sensor?
- Is the SV•Xchange™ sensor clean?
- Is the Conductivity•Xchange™ sensor clean?
- Is the Temperature•Xchange™ sensor damaged?
- Is there something nearby affecting the water temperature?
- Are debris or bubbles covering the face of the Turbidity•Xchange™ sensor?

Battery fails to fully charge:

- Is the charger connected to the data power cable?
- If the instrument is used while charging the battery the changes in power consumption can cause the charger to stop charging. The charger monitors the charging power to detect when the battery is charged; fluctuating power from the instrument can corrupt the algorithm. To ensure proper charging, manually reset the charger when you have stopped using the instrument (refer to procedure below).
- If the charger light is green but the battery voltage is less than 8 volts, manually reset the charger (refer to procedure below).
- If the charger light is green and the battery voltage is between 8 and 8.3 volts This is normal. The charger will charge the battery up to 8.3 volts and then stop charging. However if the data/power cable is left plugged in to the instrument the instrument will remain on and draw on the battery. When the battery voltage drops below 8 volts the charger will automatically turn on and start charging the battery up to 8.3 volts. The charger can be restarted at any time by manually resetting the charger (refer to procedure below).
- To stop the battery from draining down to 8 volts, unplug the data power cable from the instrument as soon as the red light on the charger turns green. This will turn off the instrument.
- To manually reset the charger: unplug the charger from the wall and plug the charger back in. This will reset the charger and start charging the battery

SeaCast fails to recognize a sensor:

- Be sure to download the latest version of SeaCast
    - Turbidity•Xchange™ requires SeaCast version 3.0 or greater for full functionality

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AML Oceanographic Contact Info

Service:
To request an RMA or technical support

Email: service@AMLoceanographic.com
Phone: 1-250-656-0771
Fax: 1-250-655-3655

Sales:
For all general sales inquiries

Email: sales@AMLoceanographic.com
Phone: 1-250-656-0771
Fax: 1-250-655-3655

Website:
http://www.AMLoceanographic.com

Customer Portal:
The Customer Portal allows AML Oceanographic customers to download calibration certificates and other related instrument documentation, view instrument details and diagnostic reports. It also allows AML Oceanographic customers to gather technical documentation, troubleshooting guides etc. RMA requests or technical support queries may also be submitted through the portal

For access to the Customer Portal, please click on the Client Service & Support button, located on the left hand side of the AML Oceanographic home page.

Mailing and Shipping Address:
AML Oceanographic.
2071 Malaview Ave.
Sidney, BC, Canada
V8L 5X6

Appendices

Commands

When using SeaCast, the command set is not usually necessary. However, text commands are available. Below is a listing of commonly used commands. Note that some commands are only be available on instruments equipped with the appropriate with Xchange™ sensors.

Communications commands

Command	Description	Requires
SET FORCE 232	Sets com mode to RS-232. Power must be cycled for changes to take effect.	
SET FORCE 485	Sets com mode to RS-485. Power must be cycled for changes to take effect.	
SET FORCE AUTO	Sets for auto-detection of RS-232 or RS-485 comms. Note that if instrument is not connected to a com port on power up, it assumes RS-485 operation & will remain in that mode until powered down.	
DISPLAY FORCE	Displays current com mode (ie RS232, RS485, AUTO)	
DISPLAY DETECT	Displays the baud rate detection settings.	
SET DETECT ab	Sets the baud rate detection. 'a' sets the number of autobaud detection attempts before the instrument reverts to the default baud rate set by 'b'. Setting 'a'=0 forces the instrument to a fixed baud rate determined by 'b'. 'b'= 1 = 600 baud 4 = 4800 baud 7 = 38400 baud 2 = 1200 baud 5 = 9600 baud 8 = 57600 baud 3 = 2400 baud 6 = 19200 baud 9 = 115200 baud	

Sampling rate commands

Command	Description	Requires
DISPLAY SAMPLE RATE	Displays the time based sampling rate	
SET SAMPLE n t	Sets the desired sampling rate. 'n' is a number and t is the time units. Examples are SET S C sets the sampling to continuous (25 Hz) SET S 5 /s 5 samples per sec SET S 1 s 1 sample per second SET S 2 /m 2 samples per minute SET S 5 m 1 sample every 5 minutes SET S 2 /h 2 samples per hour SET S 24 h 1 sample every 24 hours	
DISPLAY INCREMENT	Displays logging increment for pressure in dBars	P•X
SET PRESSURE INCREMENT n	Sets logging by increment of pressure specified by n = increment value in dBar (resolution of 2 decimal places)	P•X
SET SOUND INCREMENT n	Sets logging by increment of SV specified by n = increment value in m/s (resolution of 1 decimal place)	SV•X
DISPLAY SOUND INCREMENT	Displays the logging increment for sound velocity in m/s	SV•X

Output format commands

Command	Description	Requires
DISPLAY SCAN	Displays current scan options.	
SET SCAN NOBAT	Turns the battery channel off.	
SET SCAN BAT	Turns the battery channel on.	
SET SCAN NODENSITY	Turns the calculated density channel off.	C•X, T•X, and P•X Or SV•X, T•X, and P•X
SET SCAN DENSITY	Turns the calculated density channel on.	C•X, T•X, and P•X Or SV•X, T•X, and P•X
SET SCAN NOSALINITY	Turns the calculated salinity channel off.	C•X, T•X, and P•X Or SV•X, T•X, and P•X
SET SCAN SALINITY	Turns the calculated salinity channel on.	C•X, T•X, and P•X Or SV•X, T•X, and P•X
SET SCAN NOSV	Turns the calculated salinity channel off, removing it from the instrument output scans. Current salinity display status is viewable using DIS SCAN.	C•X, T•X, and P•X
SET SCAN SV	Turns the calculated sound velocity channel on, allowing it to be present in instrument output scans. Current salinity display status is viewable using DIS SCAN. This is only available when C,P and T sensors are attached.	C•X, T•X, and P•X
SET SCAN TIME	Enables displaying time in data scan	
SET SCAN NOTIME	Disables time from being displayed in data scan	
SET SCAN DATE	Enables displaying date in data scan	
SET SCAN NODATE	Disables date from being displayed in data scan	
DIS DELIMITER	Displays the current delimiter setting for the scan/monitor/log output. Options available are space, comma, and tab.	
SET DELIMITER SPACE	Sets the delimiter to space separated values for scan/monitor/log output	
SET DELIMITER COMMA	Sets the delimiter to comma separated values for scan/monitor/log output	
SET DELIMITER TAB	Sets the delimiter to tab separated values for scan/monitor/log output	
DISPLAY STARTUP	Displays the power up output settings	
SET STARTUP PROMPT	Sets the instrument to wait for user commands on power up.	
SET STARTUP SCAN	Sets the instrument to output one scan on powerup nd then wait for a user command.	
SET STARTUP MONITOR	Sets the instrument to start monitoring data on power up	
SET STARTUP NOHEADER	Disables the instrument identification header output on powerup.	
SET STARTUP HEADER	Enables the instrument identification header output on powerup.	

Logging commands

Command	Description	Requires
SET SCAN LOGGING	Enables simultaneous logging & real-time output. If real-time logging in air is desired, set instrument conductivity threshold and sound velocity & pressure increments to zero.	
SET SCAN NOLOGGING	Disables simultaneous real-time logging.	
SET TIMEOUT nn	nn is time in minutes from 0 to 30. Enters logging mode after the specified time interval has passed in which the instrument has been idle. Power the unit off, then on to exit the logging mode.A time interval of 0 will deactivate the command. Setting is viewable using DIS STARTUP.	
LOG	Puts unit into logging mode from real-time mode. It will remain in logging mode until power is turned off.	
SET LOG tttttttt.ttt	Sets new log file name. tttttttt.ttt = log file name. Name can have up to 8 characters in length + 3 chars for file extension	
INIT	Clears the instruments logging memory	
DIRECTORY	Displays list of files in instrument memory & memory status including amount of memory space free and used	
DUMP tttttttt.ttt	Dumps the data of the specified logged file defined by tttttttt.ttt in REAL or RAW format depending on the current instrument mode.	
DELETE tttttttt.ttt	Erases specified logged file defined by tttttttt.ttt Max 8 character name with 3 character extension.	
DISPLAY LOG	Displays current log file name	

General commands

Command	Description	Requires
SCAN	Measure and output one scan of data	
MONITOR	Scan at the set sampling rate.	
VERSION	Displays the instrument identification header.	
DISPLAY OPTIONS	Displays the instrument status and user settings	
ZERO ON	Corrects the barometric offset to set zero pressure at surface for current barometric pressure	P•X
ZERO OFF	Disables barometric offset	P•X
DIS TIME	Displays current time. Time format is HH:MM:SS.ss	
SET TIME hh:mm:ss.ss	Sets instrument time using 24 hour clock of format hh:mm:ss.ss	
DIS DATE	Displays the current date.	
SET DATE mm/dd/yy	Sets date using format mm/dd/yy	
DETECT	Checks each slot in logger board to identify what is plugged in and displays sensor / board type & serial number or empty for each slot.	
DISPLAY BATTERY	Displays battery channel coefficients and shutdown voltage.	
TALK n	Enables communications directly with a sensor board via the logger board, where n = value from 1-3 that identifies the slot number of the board to be communicated with. See Detect command.	
CTRL+C	Press ctrl key and c key at same time to exit sensor board talk mode & return to logger communications.	

Technical Specifications

Sensors

Primary Xchange™ Sensors					
Type	Range	Accuracy	Precision	Resolution	Response Time
Conductivity•Xchange™	0 to 70 mS/cm	±10 µS/cm	±3 µS/cm	1 µS/cm	25 ms at 1 m/s flow rate
Conductivity•Xchange™	0 to 2 mS/cm	±10 µS/cm	±0.6 µS/cm	0.1 µS/cm	25 ms at 1 m/s flow
SV•Xchange™	1375 to 1625 m/s	±0.025 m/s	±0.006 m/s	0.001 m/s	47 µs

Secondary Xchange™ Sensors					
Type	Range	Accuracy	Precision	Resolution	Response Time
Temperature•Xchange™	-2°C to 32°C	±0.005°C	±0.003°C	0.001°C	100 ms
Temperature•Xchange™	-2°C to 45°C	±0.008°C	±0.004°C	0.001°C	100 ms
Pressure•Xchange™	50, 100, 200, 500, 1000, 2000, 4000, 5000 & 6000 dBars	±0.05%FS	±0.003%FS	0.002%FS	10 ms
Turbidity•Xchange™	100, 400, 1000 & 3000 NTU	±1%, ±1%, ±2% & ±5% of reading	0.1, 0.2, 0.5 & 1.0 NTU	0.01, 0.01, 0.1 & 0.1 NTU	700 ms

Calculated Parameters				
Type	Required Sensors	Equation	Accuracy	Range
Salinity	C.X, T.X, P.X	EOS80	±0.010 psu	0 to 42 psu
Salinity	SV.X, T.X, P.X	AML '07	±0.035 ppt	0 to 42 ppt

Density	C.X, T.X, P.X	EOS80	±0.027 kg/m^3	990 to 1230 kg/m^3
Density	SV.X, T.X, P.X	EOS80	±0.051 kg/m^3	990 to 1230 kg/m^3

Electrical

- Mother Board
  - Flash, non volatile data memory (Minimum 1 GB)
  - 2 dedicated slots
    - Primary Xchange™ sensor slot
    - Secondary Xchange™ sensor slot
  - 1 expansion slot
- Sensor Boards
  - Sound Velocity or Conductivity Xchange™ sensor board
  - Pressure, Temperature and Turbidity Xchange™ sensor board
- Auto detect RS232 or RS485 (½ duplex ASCII)
- Autobaud to 38,400

Power

- Current
  - 250 mA when sampling
  - 50 mA in standby mode
  - 60 µA when in low power mode
- Battery voltage limits
  - 8.3 volts: Full Charge
  - 7.2 volts: Low battery warning
  - 6.5 volts: Auto shutdown

Internal Power Supply			
Status	Type	Capacity	Voltage
Standard	Lithium Ion	5.3 Ahrs	7.2 Volts

External Power Supply		
Status	Type	Voltage range
Standard	External	6.5 to 26 VDC

Pressure Case

- Environmental Limits
  - Storage, -20°C to 60°C
  - Usage, -20°C to 45°C

Housing						
Status	Type	Depth Rating	Diameter	Length	Weight (in water)	Weight (in air)
Standard	Delrin	1000 m	76mm (2.98")	565mm (22.3")	0.7 Kg (1.5 lbs)	2.2 Kg (4.8 lbs)
Optional	Titanium	6000 m			3.1 Kg (6.8 lbs)	4.6 Kg (10.1 lbs)

Connectors					
Type	Status	Pins	Sex	Material	Manufacturer
Bulkhead	Delrin instrument housings	Micro 8	Female	SS316	Subconn
Bulkhead	Titanium instrument housings	Micro 8	Female	Titanium	Subconn

Sampling Capabilities

- Frequency
  - Time: selectable sample rates from 25 per second to 1 per 24 hours
  - Pressure: specific pressure increments in 0.01 dbar steps
  - Sound Velocity: specific sound velocity increments in 0.1 m/s steps
- Configurations
  - Single scan or continuous output
  - on command or autonomous on power up

Included Items

- Minos•X instrument
- 2m Data/Power Pigtail
- Red shorting plug
- Black dummy plug
- One primary sensor blanking plug
- Two secondary sensor blanking plugs
- CD with manuals and documentation
- Battery charger
- Sensor Protection Cage

Software

- SeaCast

Ordering Codes

Instruments

PDC-MNX-P1S2-10	Minos• X, 1000 dbar, Delrin pressure housing
PDC-MNX-P1S2-60	Minos• X, 6000 dbar, Titanium pressure housing

Sensors

XCH-SV-STD	SV • Xchange™
XCH-PRS-0050	P • Xchange™ 5 bar
XCH-PRS-0100	P • Xchange™ 10 bar
XCH-PRS-0200	P • Xchange™ 20 bar
XCH-PRS-0500	P • Xchange™ 50 bar
XCH-PRS-1000	P • Xchange™ 100 bar
XCH-PRS-2000	P • Xchange™ 200 bar
XCH-PRS-4000	P • Xchange™ 400 bar
XCH-PRS-5000	P • Xchange™ 500 bar
XCH-PRS-6000	P • Xchange™ 600 bar
XCH-CND-RA070	C • Xchange™ Right Angle, Oceanographic (0-70mS/cm) Range
XCH-CND-RA002	C • Xchange™ Right Angle, Ultra Freshwater (0-2mS/cm) Range
XCH-CND-ST002	C • Xchange™ Straight, Oceanographic (0-70mS/cm) Range
XCH-CND-ST070	C • Xchange™ Straight, Ultra Freshwater (0-2mS/cm) Range
XCH-TMP-n232	T • Xchange™ -2 to 32 C Range
XCH-TMP-n245	T • Xchange™ -2 to 45 C Range
XCH-TRB-0100	Turbidity • Xchange™ 100 NTU Range
XCH-TRB-0400	Turbidity • Xchange™ 400 NTU Range
XCH-TRB-1000	Turbidity • Xchange™ 1000 NTU Range
XCH-TRB-3000	Turbidity • Xchange™ 3000 NTU Range

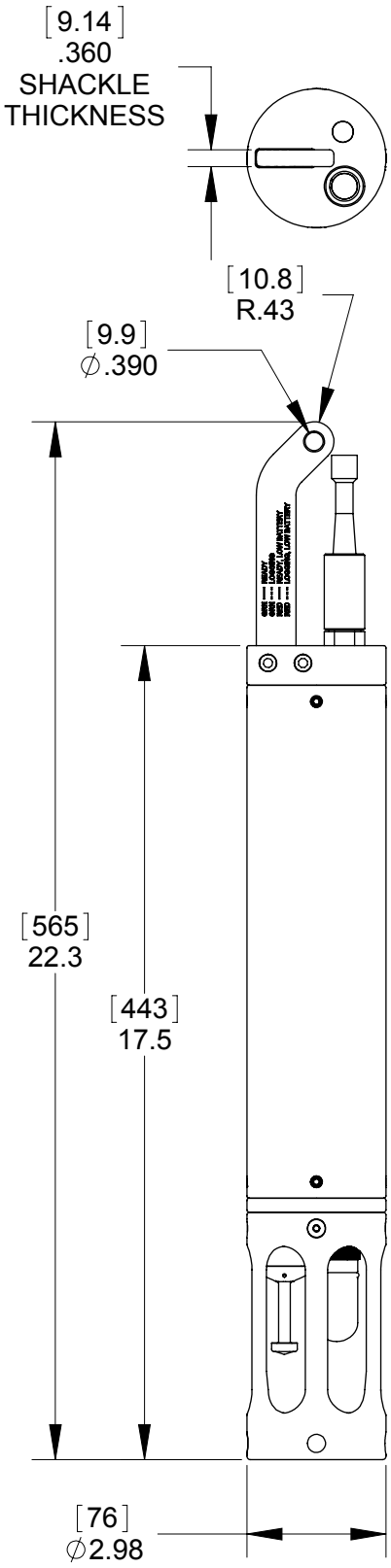
Accessories

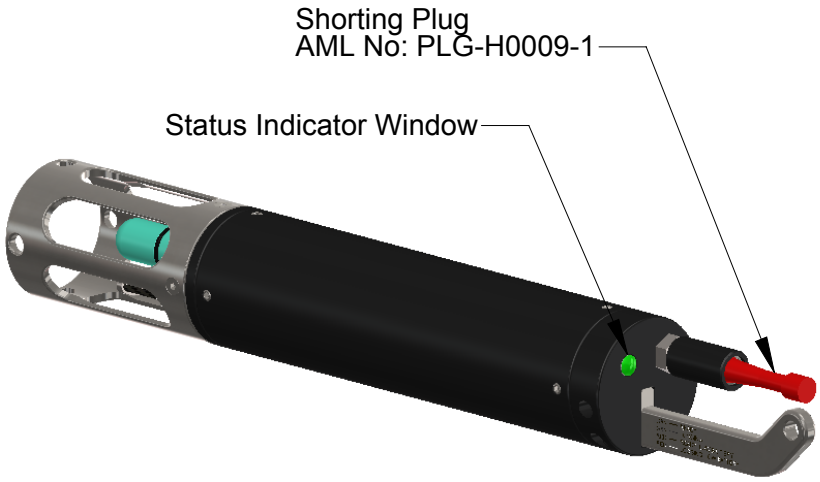
SUB-G0624	Instrument protection frame with instrument clamp
CSE-0013	Spare battery and charging adapter

Warranty

AML warrants the instrument for a period of one year from the date of delivery. AML will repair or replace, at its option and at no charge, components which prove to be defective. The warranty applies only to the original purchaser of the instruments. The warranty does not apply if the instrument has been damaged, by accident or misuse, and is void if repairs or modifications are made by other than authorized personnel.

This warranty is the only warranty given by AML. No warranties implied by law, including but not limited to the implied warranties of merchantability and fitness for a particular purpose shall apply. In no event will AML be liable for any direct, indirect, consequential or incidental damages resulting from any defects or failure of performance of any instrument supplied by AML.





NOTES:

1. Dimensions in Inches (Millimeters)
2. Material Options:
   - Delrin (Acetal Copolymer)
     - Depth Rating: 1000m
     - Weight: 2.22kg (Air), 0.70kg (Water)
   - Grade 5 Titanium (6Al/4V)
     - Depth Rating: 6000m
     - Weight: 4.63kg (Air), 3.11kg (Water)
3. Available as SV&P with optional Temperature sensor.
4. Available in CTD version.
5. X-Series option (PDC-MNX-P1S2-10/60) allows flexible, interchangeable use of the following sensors in multiple ranges:
   - C Xchange
   - SV Xchange
   - P Xchange
   - T Xchange
   - Turbidity Xchange

AML OCEANOGRAPHIC
Xchange your old ideas
2071 MALAVIEW AVE. W., SIDNEY, B.C. CANADA V8L 5X6
PH:(250) 656 0771 FAX: (250) 655 3655
www.AMLoceanographic.com

TITLE

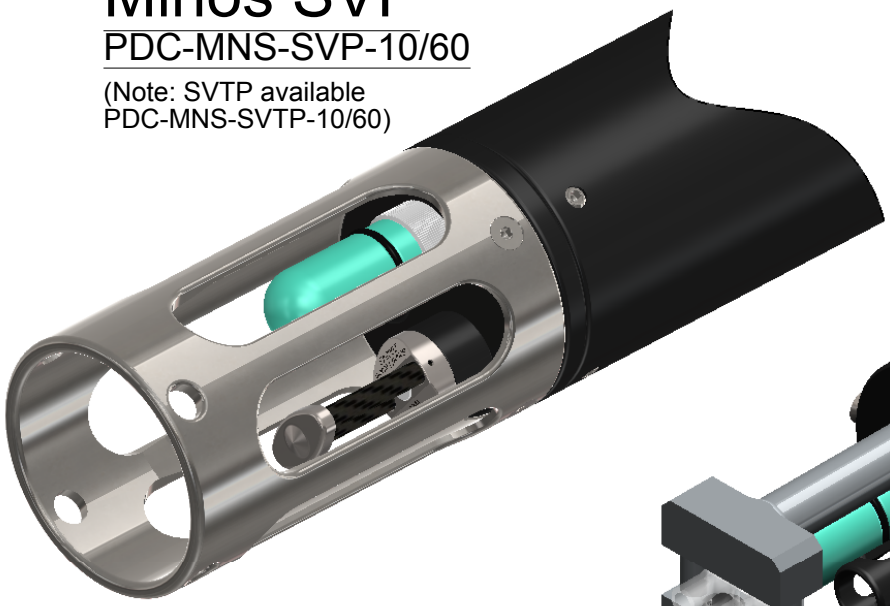
Minos SVP, CTD, and X-Series Mechanical Outline

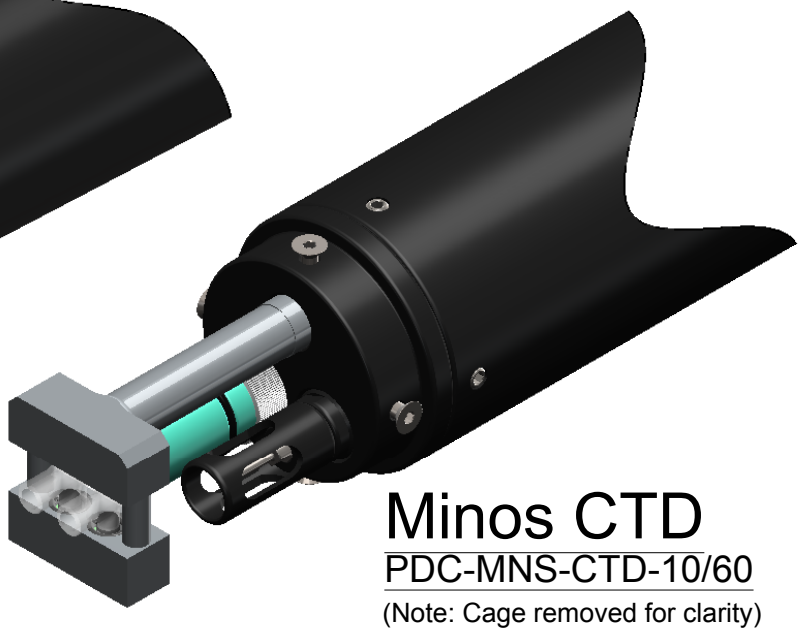
SYSTEM	*AML PART NO.*
Minos	
DATE	*SLDRW NO.*
JULY 20/11	MC4-GA-03231-E

Minos SVP

PDC-MNS-SVP-10/60

(Note: SVTP available
PDC-MNS-SVTP-10/60)





Minos CTD

PDC-MNS-CTD-10/60

(Note: Cage removed for clarity)

Minos X

PDC-MNX-P1S2-10/60

- 1 slot for an SV Xchange or C Xchange sensors
- 2 slots for P Xchange, T Xchange or Turbidity Xchange sensors

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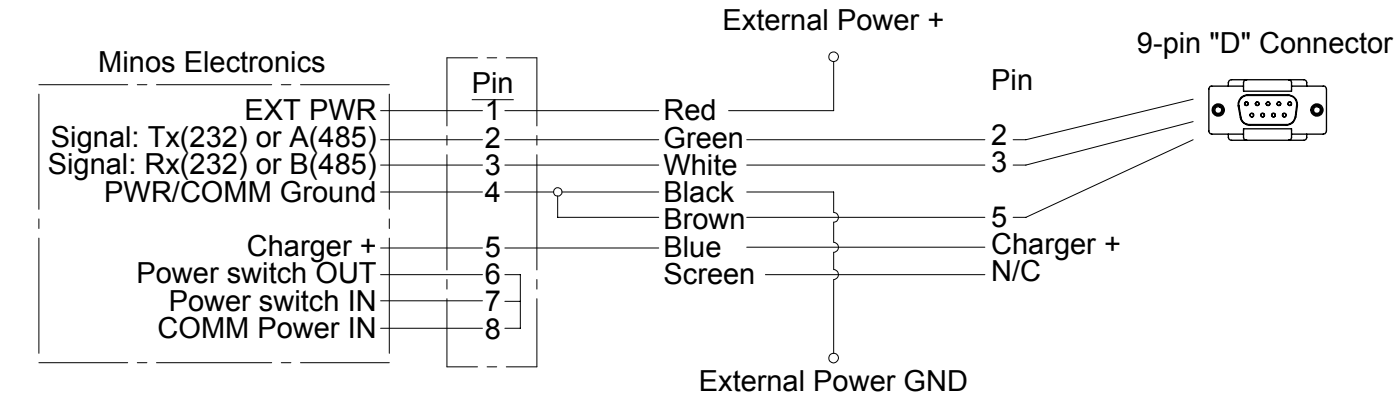
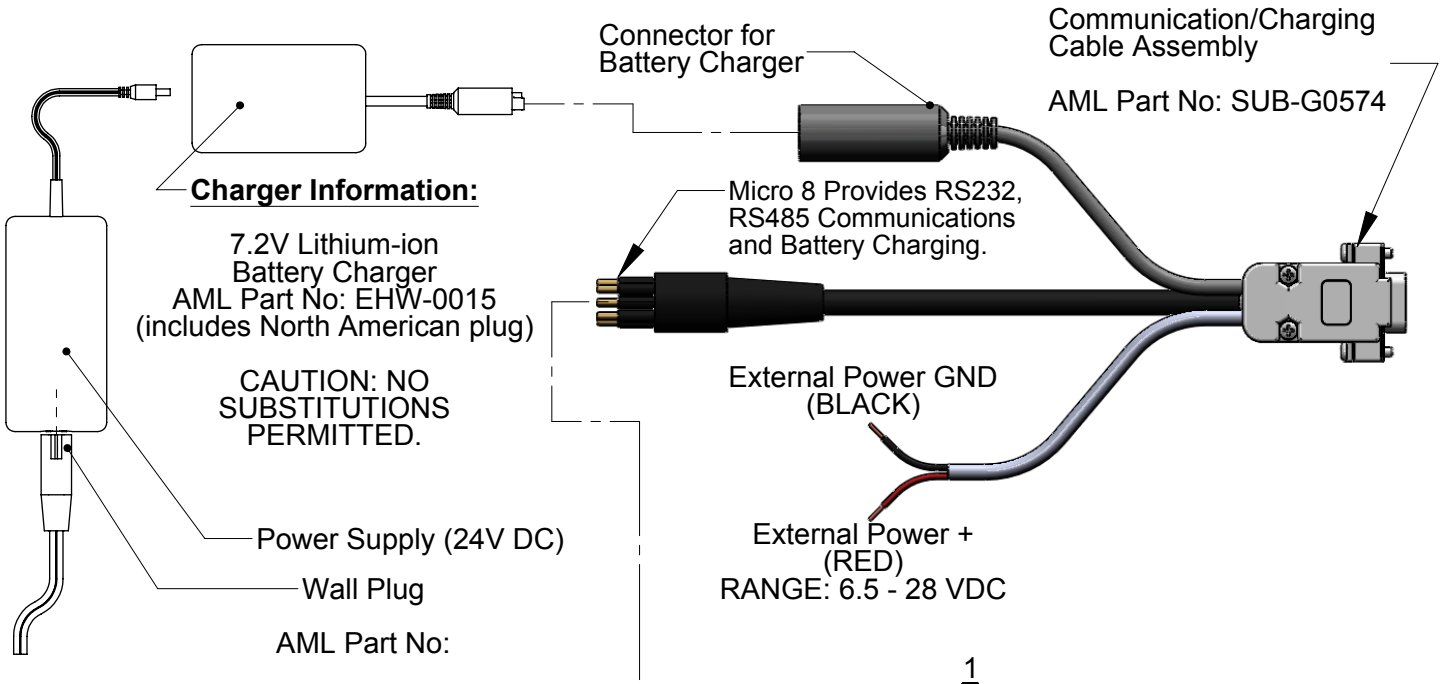
www.AMLoceanographic.com

TITLE Minos SVP, CTD, and X-Series Mechanical Outline	
SYSTEM Minos	*AML PART NO.*
DATE JULY 20/11	*SLDRW NO.* MC4-GA-03231-E





Charger Information:

7.2V Lithium-ion
Battery Charger
AML Part No: EHW-0015
(includes North American plug)

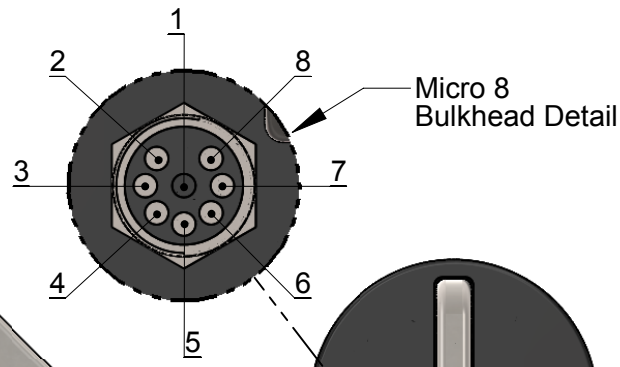
CAUTION: NO
SUBSTITUTIONS
PERMITTED.

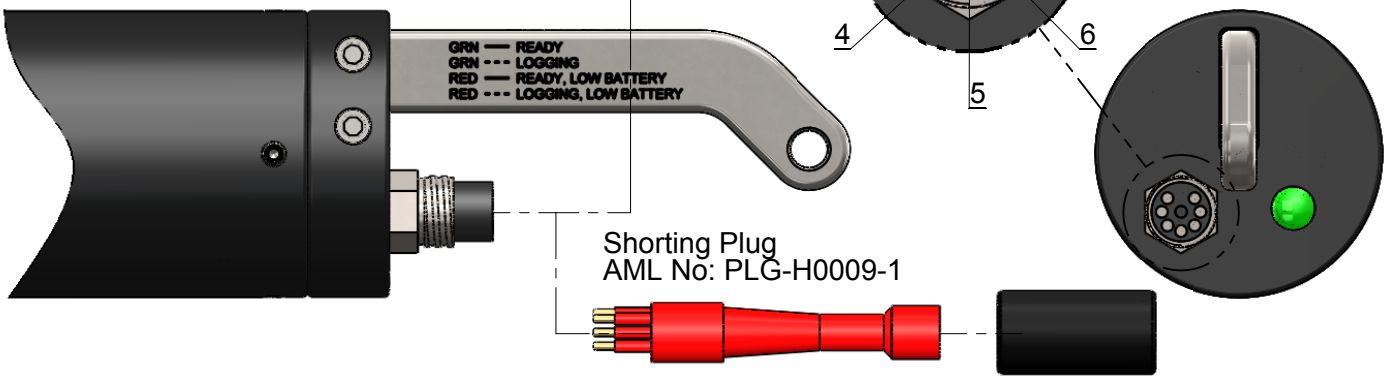
Power Supply (24V DC)

Wall Plug

AML Part No:

AUS: EHW-0016
UK: EHW-0018
EU: EHW-0017





Shorting Plug
AML No: PLG-H0009-1

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www.AMLoceanographic.com

TITLE

MINOS COMMUNICATIONS AND CHARGING INTERFACE

SYSTEM	*AML PART NO.*
MINOS	
DATE	*SLDRW NO.*
JULY 20/11	MC4-GA-03231-E